



# Forest Insect & Disease Management

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## LOSS ASSESSMENT OF WHITE SPRUCE DEFOLIATED BY YELLOWHEADED SPRUCE SAWFLY ON THE BLACK DUCK RANGER DISTRICT, CHIPPEWA NATIONAL FOREST

by

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### INTRODUCTION

The yellowheaded spruce sawfly (Pikonema alaskensis (Rohwer)) is a native insect that feeds on most species of spruce, but in Minnesota it is an especially damaging pest of white spruce (Picea glauca (Moench) Voss). The larvae begin feeding in early June on the new needles; later, when all of these are consumed, they feed on the old needles. The top of the tree is defoliated first because the insect is attracted to the sunny portions of the crown. Infestations are most common in plantations where the trees are 3 to 15 feet tall and not protected by an overstory.

In July 1977 the sawfly was studied in two white spruce plantations on the Black Duck Ranger District, Chippewa National Forest, Minnesota (Ford 1977). Forest personnel decided to take no action against the pest. This paper reports tree mortality and growth loss caused by the sawfly during the subsequent year, 1978.

### METHODS

Thirty-three temporary plots were established in a defoliated plantation (No. 16)<sup>1/</sup> along a meandering line 1,400 m long. Eighteen check plots were established in a healthy plantation (No. 18).<sup>2/</sup> Each plot included three living white spruce trees.

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<sup>1/</sup> Located in T147N, R31W, S2 off Forest Road 2177.

<sup>2/</sup> Located in T149N, R29W, S20S off Forest Road 3416.



In April 1978 sample trees were tagged, and tree height, bud diameter, and twig length were recorded. One twig from the upper third of the crown was measured for 1977 growth, and its terminal bud was measured for diameter. In June 1978 sawfly populations were estimated from a sample of 15 new shoots on one twig in the upper third of the crown of each sample tree; this sampling scheme was based on a method developed by Houseweart et al. (1974) and Houseweart and Kulman (1976). In August 1978 the number of dead trees, amount of defoliation (to the nearest 5 percent), bud diameter, twig length, and tree height of all sample trees were recorded.

Mean values for the variables were used in all calculations. Data on defoliation levels were compared to data collected during the biological evaluation in 1977. If a tree died between the April and August measurements, the change in twig length, tree height, and bud diameter was zero, and this value was included in plot averages.

## RESULTS AND DISCUSSION

In plantation No. 16, defoliation ranged from zero to 95 percent and averaged 40 percent. There was less defoliation in 1978 than in 1977 (Table 1). Each tree harbored 25 to 1,522 sawfly larvae; the average was 512 per tree. Usually 300 larvae are sufficient to completely defoliate a tree. In this case, the sampling method was inaccurate, some larvae were killed, or more than 300 larvae were needed to cause 100 percent defoliation. In plantation No. 18, trees were not defoliated and contained no sawflies.

On healthy trees, height growth was good, but twigs were shorter and buds were smaller in 1978 than in 1977 (Table 2). On defoliated trees, reductions in twig and bud growth over the previous year were expected to be in the same proportion as on healthy trees. For example, bud diameters on healthy trees averaged 4.43 mm in 1977 and 3.49 mm in 1978, a change of -0.94 mm. Buds on defoliated trees were 3.64 mm in 1977 and should have measured 2.87 mm in 1978 ( $3.64:2.87 :: 4.43:3.49$ ). However, they actually measured only 2.38 mm. The difference of 0.49 mm between expected growth and actual growth was attributed to sawfly defoliation.

In all, sawfly defoliation caused a net reduction of 17 percent in twig terminal bud diameter, 57 percent in twig length growth, and 4 percent in tree height growth (Table 3).



Table 1.--Defoliation levels in plantation No. 16 in 1977 and 1978.

Defoliation level (percent)	Percentage of trees	
	1977	1978
0-4	8	9
5-25	4	33
26-59	13	21
60-100	71	33
Dead	4	4

Table 2.--Growth differences of buds, twigs, and tree height in healthy plantation No. 18, by year.

Year	Bud diameter	Twig length	Tree height
	<u>mm</u>	<u>-----cm-----</u>	
1977	4.43	16.12	268.74
1978	<u>3.49</u>	<u>14.26</u>	<u>289.56</u>
Change in growth	-0.94	-1.86	20.82

Table 3.--Loss of bud, twig, and tree height growth in defoliated plantation No. 16 between 1977 and 1978.

Item	Bud diameter	Twig length	Tree height
	<u>mm</u>	<u>-----cm-----</u>	
1977 measurement	3.64	11.46	177.09
1978 measurement	2.38	4.36	183.13
Expected 1978 measurement	2.87	10.13	190.81
Loss to sawfly defoliation	0.49	5.78	7.68



## CONCLUSIONS

The "no action" alternative selected for plantation No. 16 failed to meet at least three of the four objectives shown in the presuppression and postsuppression plan.<sup>3/</sup> These objectives were:

1. Prevent tree mortality.  
In plantation No. 16, 4 percent of the trees died because of sawfly defoliation.
2. Maintain foliage.  
Although defoliation levels were lower than in 1977, trees in plantation No. 16 suffered 40 percent defoliation.
3. Reduce sawfly populations.  
No counts of sawflies were made in 1977; therefore, no conclusions can be made about this objective.
4. Restore vigor to the trees.  
White spruce in plantation No. 16 were less vigorous than trees in plantation No. 18 in terms of growth in bud diameter, twig length, and tree height. Growth losses were 17, 57, and 4 percent, respectively.

## LITERATURE CITED

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<sup>3/</sup>Ford, Robert P. 1978. Presuppression and postsuppression evaluations for yellowheaded spruce sawfly, Chippewa National Forest. Unpublished work plan. USDA For. Serv., Northeast. Area, State and Priv. For., St. Paul, Minn.